Research Note

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION
OGDEN UTAH

U.S. Forest Service
Research Note INT-55 1966

HERBICIDES FAIL TO INSURE SUCCESS OF A BRUSHFIELD PRESCRIBED BURN[1]

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ABSTRACT

Seven herbicide spray treatments were compared for their effectiveness in killing brush to prepare a north Idaho brushfield for prescribed burning, and in controlling brush regrowth after the fire. Deadening of the brush did not appear to contribute to success on south- and west-facing slopes, where all plots burned well regardless of the degree of brush kill. On north-facing slopes, the fuel moisture content remained high because of an unusually cool and wet summer, and attempts at burning failed completely even on plots with much dead brush. Brush regrowth on burned areas was not substantially reduced by spraying.

As a result of repeated wildfires and logging practices unfavorable for natural reforestation, brush cover prevails on more than 3/4-million acres of potentially productive forest land in northern Idaho. In reclaiming these acres by artificial reforestation, brush needs to be eliminated or reduced to facilitate planting as well as to reduce competition to newly planted trees. Attempts to remove dense stands of brush by prescribed burning have not always succeeded. Failure occurs most often on north-facing slopes where the brush is usually taller and more dense, and where cool and moist conditions persist longer. On such north-facing slopes, past use of a foliage spray (2,4-D and 2,4,5-T mixture) to kill at least the taller brush and permit faster

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[1] This administrative study was conducted in cooperation with the Coeur d'Alene National Forest and the Division of Timber Management, Region 1, U.S. Forest Service.

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drying of the fuel has often been disappointing because of a poor degree of brush kill. To find a treatment that would promise a higher degree of success, several herbicide treatments were tested on a 225-acre brushfield on the Coeur d'Alene National Forest in northern Idaho.

METHODS

The general aspect of the selected site was westerly, but some portions of interior subdrainages faced almost to the north and other portions to the southwest. The slopes were steep, exceeding 60 percent on most of the area. Elevation varied from about 4,400 to 4,900 feet. The brush species present were quite generally represented throughout the area, but the taller-growing species were more prevalent on the lower part of the area and on north-facing slopes.

The area was divided into four plots of approximately 50 acres each; two plots were on the upper slope and two were on the lower. One of each pair was randomly selected for further division into four subplots (using logging roads and topographic features as boundaries); herbicide treatments that included early spraying of the brush in a dormant condition were randomly assigned to these subplots. The other two plots were similarly divided, and three herbicide treatments that involved spraying of the brush in only the leafed-out stage were randomly assigned to three of the four subplots. The unselected subplot in each large plot was eliminated from the study.

Each of the seven treatments was assigned an identifying number and is described as follows:

Treatment no.	Description
1	Dormant spray consisting of 2 lbs. acid equivalent (a.e.) of low-volatile ester of 2,4,5-T and 9-2/3 gallons of No. 2 diesel oil per acre.
2	Treatment #1 plus a later foliage spray consisting of 3 gallons of Tordon 101[3] mixed with 7 gallons of water.
3	Treatment #1 plus a later foliage spray consisting of 1 gallon of Tordon 101 mixed with 9 gallons of water.
4	Treatment #1 plus a later foliage spray consisting of 2 lbs. a.e. of a mixture of 2,4-D and 2,4,5-T (1 lb. a.e. of each), 1 gallon of white diesel, and $8\frac{1}{2}$ gallons of water.
5	Foliage spray consisting of 3 gallons of Tordon 101 and 7 gallons of water.
6	Foliage spray consisting of 1 gallon Tordon 101 and 9 gallons of water.
7	Foliage spray consisting of 2 lbs. a.e. of the mixture of 2,4-D and 2,4,5-T, 1 gallon of white diesel, and $8\frac{1}{2}$ gallons of water.

[3]Dow Chemical Co. registered trademark for a formulation of 4-amino-3,5,6-trichloropicolinic acid ("Tordon," $\frac{1}{2}$ lb./gal.) and 2,4-D (2 lbs./gal.), both as the triisopropanolamine salt. The use of the trade name of commercial products is solely for identification and does not imply endorsement by the U.S. Department of Agriculture or the Forest Service.

All herbicide was sprayed by helicopter at the rate of 10 gallons of solution per acre. Dormant spraying was begun as soon as the snow melted in late May. Foliage-spray treatments were begun on June 25, after the leaves had attained three-fourths or more of full development, and were completed on June 29. Temperatures during the June 25-29 period ranged between 40 and 55° F. while spraying was in progress. Relative humidity was approximately 60 percent. Throughout the remainder of that growing season, the weather was unusually cool and wet; and although prescribed burning was planned for mid-August, rainy weather forced postponement until mid-September.

Effects of treatment were measured on four randomly located 1/100-acre circular plots in mid-August of the year of treatment. Estimates were based on the percent of individual shrubs that were outwardly dead. Another examination was made in early October to determine effects of treatment on success of the prescribed burning; these evaluations were based on visually estimated percentages of sample-plot surface that received a satisfactory burn.

Further observations were made during the next growing season. Brush recovery was measured on sample plots that had burned well. On sample plots that had not burned, general observations were made on the recovery or further decline of the brush plants. Douglas-fir trees were planted in May and examined in September to detect effects of possible residual Tordon in the soil. Also, soil samples were collected from each 6-inch layer from the surface to a maximum depth of 36 inches. These were bioassayed by the Dow Chemical Company.

RESULTS

One and a half months after spraying, effectiveness of the herbicides varied with the species of brush (table 1). Taking into consideration the cost of double applications, treatment #6 seemed to be best for most of the species studied here (fig. 1). Treatment #7 gave the least kill. It was about half of that achieved by treatment #1, which in turn was only about half as good as the Tordon treatments #2, #3, #5, and #6.

At the end of the second growing season, observations made on unburned plots that had been sprayed with treatments #4 and #7 showed most species were sprouting both aerially and basally. Regrowth of huckleberry was much reduced, however, on areas that received a dormant spray. On plots receiving foliage treatments of Tordon, huckleberry mortality was light the first year but almost complete by the time of second-year measurements. Snowberry was similarly affected by Tordon but to a lesser degree. The mountain maple, on the other hand, developed some weak basal sprouts during the second year. Myrtleleaf remained substantially unaffected by any of the treatments through the second year.

Combined statistical analyses of data for all species showed that (1) position of brush on the upper or lower slope did not affect the ability of the herbicides to kill the brush, and (2) only treatment #7 (foliage spray of mixed 2,4-D and 2,4,5-T), which was quite ineffective, differed significantly from the others.

Table 1. --Most effective treatment and apparent first-year kill for major brush species

Species	Treatment no.[1]	Percent of kill
Mountain ash (*Sorbus scopulina* Greene)	6	90
Mountain maple (*Acer glabrum* Torr.)	6	[2]80
Huckleberry (*Vaccinium* spp.)	1	80
Snowberry (*Symphoricarpos* spp.)	2	50
Myrtleleaf (*Pachistima myrsinites* (Pursh) Raf.)	None	0
Spiraea (*Spiraea* spp.)	[3]6	93
Rose (*Rosa* spp.)	[3]All	100
Serviceberry (*Amelanchier alnifolia* Nutt.)	[3]6	97
Snowbrush ceanothus (*Ceanothus velutinus* Dougl.)	[3]1	99

[1]Where treatment #6 is listed, treatments 2, 3, and 5 gave comparable results, but are more expensive than 6.

[2]Observations on subsequent studies reveal that this species in other areas has been affected much less by this treatment.

[3]Not all treatments were tested because too few of the plants were present on the sample plots.

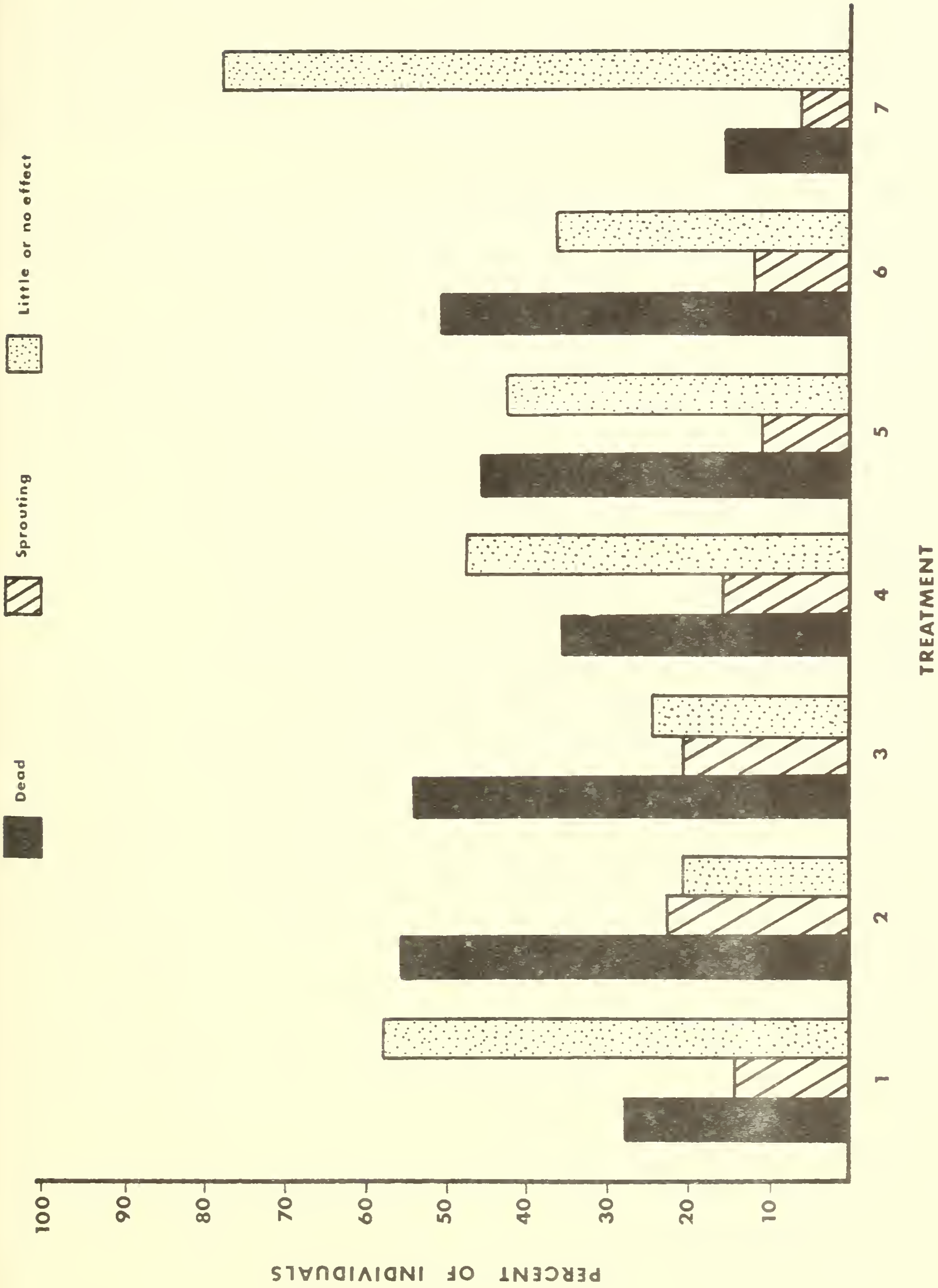

Figure 1. Effectiveness of treatments on all species.

There was no relation between the amount of brush killed by the different herbicide treatments and the percent of surface area that received a complete burn. In fact, the plot with the greatest percent of individual shrubs killed prior to burning had only 15 percent of its surface completely burned, while the plot that had the least amount of brush killed had over 50 percent of its area burned completely. The decisive factor was aspect of the particular location. All north-facing plots burned poorly or not at all. All plots facing to the south or west burned well regardless of the degree of prior brush kill.

Regrowth of brush on the burned plots did not appear to be affected by the herbicide treatment except on the plots receiving treatment 5. Fewer basal sprouts appeared here than on the other treatments (table 2).

The bioassays for residual Tordon in the soil (sensitive to concentrations of less than 0.001 ppm.) indicated no herbicide present for all sampled depths $12\frac{1}{2}$ months after treatment. Also, survival (94-100 percent) and growth (1.6-1.8 inches) of the Douglas-fir planted in the spring of the year following treatment revealed no damaging effects from the herbicide.

Table 2.--Brush regrowth on satisfactorily burned plots at the end of the second season following herbicide treatments

Herbicide	Mean number of stems per 1/100-acre plot		
	Basal sprouts	Stems with aerial sprouts	New seedlings
2,4-D and 2,4,5-T	46	1	16
Tordon 101 (1-gallon rate)	62	0	169
Tordon 101 (3-gallon rate)	24	1	11

DISCUSSION

The main reason for applying herbicides is to reduce brush competition to encourage present or subsequent tree regeneration. But another objective, especially important in brushfield areas, is to kill the brush quickly and thereby produce better fuel conditions for effective burning and clearing of the site prior to planting. This study indicates that the latter goal cannot always be attained on north-facing slopes in northern Idaho, and it seldom may be necessary to try it on south-facing slopes.

On any particular area, the species' composition must be known before an herbicidal treatment can be recommended with any confidence. Identification of treatments that appeared most effective initially on different species (table 1) could be useful in situations where a maximum amount of dead brush material is needed toward the end of the same growing season to improve chances of success in prescribed burning. However, none of the herbicides tested gave much promise of reducing brush regrowth markedly after the burn. Though treatment 5 seemed to inhibit resprouting, results were too limited to justify the cost of this heavy application.

Ceanothus made up the bulk of the new seedlings established on the area in the second year. Their numbers varied greatly from place to place, apparently as a reflection of the amount of *Ceanothus* seed present before burning rather than as a result of any residual effect of treatments.

The merits of herbicidal sprays as a preparatory measure for prescribed burning must be judged on the basis of specific conditions. If the aspect is generally southerly, chances are good that brush killing prior to the burn is not necessary. If the site is generally northerly and the predominant species are herbicide-susceptible, spraying might well be warranted. However, if weather is not conducive to drying, or if favorable drying conditions are allowed to pass before burning is done, even a spray that kills the brush cannot assure a good burn.

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